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SURVEY OF EUROPEAN COMPOSTING FACILITIES

JULY, 1981

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Ontario
Ministry of the Environment

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Minister

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Deputy Minister

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SURVEY

OF

EUROPEAN

COMPOSTING FACILITIES

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WASTE MANAGEMENT BRANCH

ONTARIO MINISTRY OF ENVIRONMENT

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SUMMARY

In order to obtain accurate and current information on European composting activities, a field trip involving visits to typical composting facilities in Germany, Austria, and France was undertaken. A broad spectrum of plants was visited including those with extensive pre-processing facilities as well as simple drum-type operations.

Emphasis was placed on obtaining information in the areas of:
municipal waste management practices,
facility ownership and maintenance responsibility,
technical considerations of composting, and
compost utilization and marketing.

The report concludes that while composting technology is well-established, markets for the finished product are area-specific with no general assurance of a compost market. The costs of composting, including revenues, are invariably greater than those for landfilling.

The report also concludes that any decision to use composting as a waste management technique must be made on factors other than simple economics, such as non-quantifiable environmental advantages, land saving, and resource utilization.

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INTRODUCTION

Solid waste disposal practices in the Province of Ontario have gradually evolved from open dumps, open burning, and crude incineration to methods involving sanitary landfills, incinerators with emission controls, and limited resource recovery operations. However, most of the solid waste in the Province is disposed of in sanitary landfills. Even this engineered approach has given rise to concerns over environmental issues, consumption of agricultural lands, as well as desecration of "unspoiled lands".

As a result of these concerns, there has been a continuing and increasing interest of smaller municipalities in composting as a waste management technique, and more particularly from those communities generating in the order of 50 to 100 tonnes per day of solid waste.

In order to provide a complete assessment of the composting alternative, detailed information was required in the following areas:

- design aspects of various composting systems,
- system performance with respect to both the composting process and unit operations,
- capital and O and M costs, and
- raw waste feed stocks, product quality, and markets as well as non-revenue producing end uses.

A review of the available literature yielded minimal current information in these areas. While new composting plants receive considerable publicity and are the subject of technical articles, a significant information gap exists with respect to the current status of most of these plants. Operating problems, marketing difficulties, and even plant closures are rarely reported. It should be noted that a somewhat similar situation exists with respect to resource recovery facilities.

Composting of solid waste and waste water sludges has been practiced in Europe for several decades. Numerous proprietary composting systems have evolved from these efforts. Frequently an impression is formed that European composting practices are well established with respect to technology, product utilization and marketing. In order to obtain accurate and current information, it was considered that a field trip involving visits to typical composting facilities would likely be the most practical and meaningful method of fulfilling this need. The information gained from such a visit could be expected to provide an excellent benchmark against which to gauge the composting system performance at the Ministry's Experimental Plant for Resource Recovery as well as the Ministry's compost marketing and market development efforts.

BACKGROUND

The selection of the composting facilities to be visited in Europe was made primarily utilizing available literature on the composting of solid waste. An attempt was made to ensure that a broad spectrum of processing facilities was covered during this visit, including plants with no refuse pre-processing followed by drum composting and windrowing, to those where extensive solid waste processing was conducted prior to preparing a compost feed stock.

A listing of the plants visited is shown in Table 1. The plant visits generally took the following form:

- a review of solid waste management practices for the particular municipality,
- discussion of plant ownership and O and M responsibility,
- inspection of plant followed by a discussion with management and operating personnel on pertinent aspects including compost utilization and marketing.

The tour group comprised the following:

- Dr. R. Frank, Director, Pesticide Residue Laboratory, Ontario Ministry of Agriculture and Food
- Mr. P. Sibbick, Chairman, Oxford County Solid Waste Management Commitee
- B.I. Boyko, Supervisor, Resource Recovery, Waste Management Branch, Ontario Ministry of the Environment.

Plant visits took place from September 8 to September 20, 1980.

Table 1

COMPOSTING FACILITIES VISITED

Location	Plant Type	Capacity
Bad Kreuznach, Germany	Revolving Drum	40 tonnes/day
Schweinfurt, Germany	Brikollare (rasping and briquetting)	40 tonnes/day; processing 70 t/day
Siggerweisen, Germany	Arus. Ruther (extensive processing, drum composting and forced-air maturation)	350 tonnes/day
Zell-am-See, Austria	Voest-Alpine (shredding, drum composting and forced-air maturation)	140 tonnes/day; processing 70 t/day
Avignon, France	Triga (shredding, digestion in vertical towers with forced aeration)	120 tonnes/day
Cavaillon, France	SOBEA (Revolving Drum)	80 tonnes/day; processing 36 t/day
St. Mitre, France	Brikollare (shredding and briquetting)	90 tonnes/day; processing 80 t/day
Melun, France	Carel-Fouche (shredding, digestion in rectangular vertical towers with forced aeration)	76 tonnes/day; processing 60 t/day
Orlean, France	Carel-Fouche (as above)	150 tonnes/day

DESCRIPTION OF COMPOSTING FACILITIES VISITED

Bad Kreuznach, Germany, Population 43,000

The 23 year old composting facility at Bad Kreuznach was originally a multilevel government operation with a commitment from local vineyards to use some of the produced compost. At present, the plant is privately owned and operated by the company responsible for solid waste collection in Bad Kreuznach. Landfill is used as the alternative disposal facility.

Only domestic refuse and waste water sludge is processed with approximately 40 tonnes per day solid waste and 6 tonnes per day dewatered sludge reportedly handled. Glass separation at-source is encouraged but not significantly practiced to any marked degree.

The process consists of feeding raw refuse and dewatered sludge into a revolving drum, magnetically removing ferrous material from the drum discharge and subsequently screening the refuse/sludge mixture. No shredding is involved. Approximately 50% of the feed stock ends up as compost.

The compost product is quite coarse with large pieces of glass (nominal 1 inch) present.

Plant housekeeping was excellent although there was not any recent evidence of the production of raw compost or of reject material even though the plant visit took place late in the afternoon.

The operation of the plant may be marginally profitable considering the capital debt of the facility has been discharged; estimated operating costs for a new facility including amortization were given at approximately 60 DM per tonne of refuse, or $40.00 Can per tonne.

Plant staff totalled five, including the facility manager.

Virtually all of the compost was used as a mulching material in vineyards for the purpose of erosion control. The material was applied as a mulch only and not worked into the soil. The market price for the finished product was indicated to be 15 DM per cubic metre, (1 DM equivalent to $0.66 Can at time of visit).

It was interesting to note that the application of compost took place only after the grapes were harvested. This limited time of application, fall and early winter, means that the finished compost is stored on site for approximately 9 months prior to usage.

The quality of "Kreuznacher Kompost" is shown in Table 2.

The facility at Bad Kreuznach appeared to have low capital and operating costs, but compost quality could best be described as merely adequate.

Even without the burden of amortization, operating costs of the composting facility are higher than the costs associated with landfilling. Operating costs were approximately equivalent to those for landfilling if product revenue was included. It would appear that the private owner/operator is continuing the operation of the facility to obtain corporate experience in this area as well as provide some enhanced public relations as composting is generally viewed as a "good thing to do."

Table 2

"KREUZANACHER KOMPOST"

Quality of Compost Produced at Bad Kreuznach:
Analytical Information Supplied by Operating Company

Ash	58.0%
Organic Material	47.0%
Degradable Organics	31.5%
Total Carbon	22.5%
Inorganic Carbon	16.3%
N	8,000 ppm
P_2O_5	6,000 ppm
K_2O	5,000 ppm
MgO	7,000 ppm
CaO	64,000 ppm
Iron	2,600 ppm
Zinc	990 ppm
Copper	258 ppm
Manganese	470 ppm
Boron	15,9 ppm
Lead	600 ppm
Molybdenum	1.3 ppm
C/N ratio	28:1
pH	7.4

Analytical results presented on a dry weight basis.

Schweinfurt, Germany, Population 80,000

The composting facility at Schweinfurt is owned and operated by the local municipality. This facility was constructed in 1965 at a cost of 4.5 million DM. The overall solid waste management system for the municipality includes incineration for industrial wastes, landfill for oversize bulky wastes, and composting of domestic wastes. In the event of problems with the composting plant, domestic wastes are then landfilled.

The following is a description of the processing system at the Schweinfurt composting facility:

- manual removal of glass and non-processable items
- rasp mill
- ferrous removal
- screening with minus 30 mm material receiving further processing and oversize material to incineration
- ballistic separation for removal of heavy inerts
- mixing with dewatered sludge in pugmill
- briquetting and palletizing
- surplus feed stock windrowed

The compost receives a final finishing by either shredding and air classifying or shredding and screening.

The facility processes approximately 18,000 tonnes of refuse and 22,000 of dewatered sludge annually, corresponding to daily refuse handling of about 75 tonnes. The plant only operates on one 8 hour shift with 6 hours being devoted to actual processing of refuse and 2 hours for maintenance. Total plant operating staff numbers ten.

Gross plant operating costs were indicated as being 70 DM per tonne or $47.00 Can per tonne, including amortization. Net operating costs were reported as 60 DM per tonne. The municipal cost for landfilling wastes was given as 30 DM per tonne, again indicating that the compost operation is governed by factors other than mere economics.

The original briquetting machine installed in 1965 is unable to handle the present quantity of waste available for composting and consequently approximately one half is briquetted with the surplus being windrowed. However, the briquetted materials are subsequently shredded after 3 weeks storage and then mixed with surplus raw material for simple windrow composting. This windrow composting appears to be essential in order to obtain a reasonable product as briquetted material after 3 weeks storage merely resembles dried refuse derived fuel. On the other hand, the municipality appears to be satisfied with the present operation as they are now considering a 3.5 million DM expenditure for expansion of the facilities including an additional briquetting press, a composting hall for storage of the palletized briquettes, and additional buildings for increased working space.

Again the compost is marketed to vineyards for erosion control purposes only, at a price ranging from 12 to 15 DM per tonne, $8 to $10 Can per tonne. A very small quantity of premium compost (screened to minus 8 mm) is sold at 36 DM per tonne.

The characteristics of the compost produced at Schweinfurt are shown in Table 3.

Table 3

"FERTIGKOMPOST"

Quality of Compost Produced at Schweinfurt:
Analytical Information Supplied by Operating Municipality

Ash	63.8%
Organic Material	36.2%
Inorganic Carbon	15.3%
N	6,700 ppm
P_2O_5	10,000 ppm
K_2O	3,370 ppm
KCl	1.8%
Manganese	500 ppm
Copper	220 ppm
Zinc	790 ppm
Boron	38 ppm
Lead	360 ppm
Cadmium	3 ppm
Nickel	28 ppm
Chrome	43 ppm

Analytical results presented on a dry weight basis.

Arus-Ruthner System, Salzburg, Austria, Population 320,000

The most sophisticated composting facility visited was undoubtedly the Arus-Ruthner plant at Siggerwiesen, Austria, a regional co-disposal facility serving the municipality of Salzburg. The facility was placed into service in 1978 at a capital cost of 9.6 million Austrian schillings, corresponding to an estimated 1980 capital cost of $15 million Can, all privately financed. Private capital appears to have been provided on a venture basis rather than as an investment with an expected percentage return on investment. The system supplier, Arus-Ruthner, has no involvement with the private company owning and operating the facility.

The plant is operated on a one shift basis, processes approximately 350 tonnes per day, and has a total staff of 18 with 10 in operations and 8 in maintenance. Management staff are not included in this total.

Tipping fees are approximately $25 Can per tonne (3.6 Austrian schillings per 90 litres of refuse) and it was indicated that the tipping revenue covers all operating and amortization costs, without any compost revenue.

Apparently composting was chosen as the waste management alternative that was felt to yield minimal environmental disruption. Undoubtedly this was of extreme significance since tourism is the major industry in the Salzburg area. Landfilling is used for disposal of process rejects, unprocessable wastes, and as an alternative disposal method.

The Arus-Ruthner system for composting of refuse and wastewater sludge consists of the following process steps:

- shredding
- ferrous removal
- sludge addition (6% raw sludge)
- drum composting for approximately 24 hours
- maturing of raw compost in aeration hall
- compost finishing either by screening, rod milling for glass crushing, or beneficiation through fertilizer or bentonite addition.

Although the plant is quite sophisticated, the emphasis rests merely on providing a mixture of sludge and prepared refuse which is then subjected to accelerated composting in a rotary drum followed by maturation. As with other facilities, this mixture after maturing for 3 to 4 weeks requires extensive upgrading prior to being considered a suitable product for marketing.

The feed to the composting system consists of approximately two-thirds refuse and one-third sludge by weight and finished product represents some 50 to 60% of the raw tonnage processed.

It appears that very little compost product is being marketed with most of the raw compost produced merely directed to landfill. The company is undertaking a considerable amount of market development work with the major thrust being in the use of compost as a substitute for a peat-like substance called "torfe". In addition the company has also conducted a number of relatively simple growth tests in conjunction with the University of Salzburg and uses these results in a public relations and marketing effort.

Analytical data on the compost produced at Siggerwiesen is shown in Table 4.

According to the operating company's general manager, there does not appear to be a great concern in Austria over compost quality and heavy metal concentrations. It appears likely that they would adopt the same guidelines and proposed limiting metal concentrations as established for Germany. For this plant at Siggerweisen, sludge is obtained from the Salzburg wastewater treatment facility and that municipality has virtually no industry excepting tourism.

The trial work involving the addition of bentonite and fertilizer to finished compost was undertaken primarily for marketing the product to the luxury horticultural market.

Table 4

SIGGERWIESEN COMPOST

Quality of Compost Produced at Siggerwiesen:
Analytical Information Supplied by Operating Company

Moisture		32%
Volatile Matter		48.5%
Degradable Organics		23.7%
Salt Content		1.4%
pH	7.3	
N	1.0%	
P_2O_5	0.5%	
K_2O	0.3%	
MgO	0.9%	
CaO	1.6%	
Boron	0.003%	
Manganese		0.06%
Zinc	0.09%	
Copper	0.06%	

All analytical results presented on a dry weight basis.

Voest-Alpine, Zell am See, Austria, Population 120,000

The composting facility serving the municipality of Zell am See features the Voest-Alpine system, a process almost identical to that of Arus-Ruthner including shredding, mixing with sludge in rotary drum, and the use of a composting hall with forced aeration through the floor including exhausting the air through biological filters, i.e. beds of compost. The operating authority is a private company that operates the facility based on tipping charges alone, without being dependent on any compost revenue. Operating costs are believed to be approximately $25 to $30 Can per tonne including facility amortization.

The plant was placed in service in 1978 at a capital cost of $5 million Canadian and while designed for 140 tonnes per day only receives at present approximately 70 tonnes per day. During a normal shift the plant processes waste for 4 to 5 hours and carries out required maintenance over the remaining three hours in the shift.

Total plant staffing is five, including the plant manager, with the operating staff carrying out required maintenance duties during the non-processing time as indicated above.

Landfill provides the alternative disposal facility for the municipality.

The prime function of this facility, as with the one in Salzburg, is to process and dispose of refuse with the marketing of the compost product being of secondary importance.

The plant processing flow is virtually identical to that of the Ares-Ruthner system, with the exception that no additional compost finishing equipment was in service at this time. However, it was expected that compost screening would be installed within the next year.

This facility composts refuse and waste water sludge in a ratio of 3 to 1 respectively on a weight basis.

From very limited information gathered, it appears that landfilling costs are approximately one third of the processing costs of the composting plant. The municipality apparently has chosen composting as a waste management tool without any detectable economic or significant technical reasons.

No markets exist for the compost produced at Zell Am See and while the agricultural and horticultural areas are expected to open up as markets, no commitments or even preliminary contacts with users in these areas have been established to date.

Expected quality of the compost produced from the Voest-Alpine system is shown in Table 5.

Table 5

ZELL AM SEE COMPOST

Quality of Compost Produced at Zell am See:
Analytical Information Supplied by Operating Company

Moisture	30 - 35%
pH 7.5 - 8.5	
Total N	0.6 - 1.0%
Volatile Matter	20 - 30%
C:N ratio	20:1

All analytical results presented on a dry weight basis.

Avignon, France, Population 280,000

At Avignon, the Triga Company, a subsidiary of Lyonnais des Eaux, has built a combination composting-incineration plant. The facility is owned by the municipality, operated by Triga, and was placed in service in 1974. Again, only domestic refuse is handled with industrial wastes being collected privately and landfilled separately.

The facility does not provide for co-disposal of wastewater sludges; it was indicated that the raw refuse contains 45 - 50% moisture, adequate for composting.

The dominant feature of the Triga composting system is the use of vertical towers with forced aeration for the digestion of milled refuse. The towers were basically adapted from silos used for the storage and retrieval of wood chips in the pulp and paper industry. The composting system consists of initial ferrous removal, shredding in a Hazemag pulverizer, a nominal four days of aerobic digestion, and screening of the material to produce a raw compost followed by product windrowing.

The entire facility receives 200 tonnes of refuse daily with 100 to 120 tonnes being composted. Approximately 30 to 40% of the overall waste processed through the composting system reports as finished product. The composting system is capable of handling wastes at a rate of 20 to 25 tonnes per hour with the overall solid waste facility operating 2 shifts per day, and six days per week.

The tipping fee for wastes delivered to the facility is 55 - 60 FF per tonne corresponding to $17 - $18 Can per tonne; landfilling costs were reported to be approximately 20 FF per tonne, or roughly one-third of the cost of composting. It is interesting to note that the incineration costs were in the order of 80 - 90 FF per tonne.

At this facility the material leaving the digestion towers was very poor in appearance, resembling little more than shredded refuse. This was likely the result of material residence times in the tower being very short, 40 to 48 hours compared with the nominal design period of 96 hours. Extensive equipment for composting finishing was in evidence although did not appear to be routinely used.

According to Triga representatives, almost all of the compost produced at Avignon is marketed for erosion control purposes in vineyards with the selling price ranging from 20 - 30 FF per tonne, F.O.B. plant facility. Although specific analyses of the compost product produced at Avignon were not available, the typical quality of compost produced in France is shown in Table 6, with this information being provided by a soil scientist of the Triga Company.

The operating staff for the Avignon composting plant consisted of five men per shift with this figure including the required maintenance staff.

Table 6

Typical Compost Quality in France:
Information as Supplied by the Triga Company

Moisture		35%
pH	7.8	
C/N ratio		15 - 20:1
C	15%	
N	0.9%	
P_2O_5	0.6%	
K_2O	0.3%	
Ca	4.0%	
Mg	0.3%	
Na	0.3%	
S	0.6%	
Cl	0.5%	
Fe	2.2%	
Boron (total)		64 - 245 ppm
Boron (soluble)		10 - 31 ppm
Zn	1,000 ppm	
Mn	600 ppm	
Cu	250 ppm	
Pb	600 ppm	
Cd	7 ppm	
Cr	270 ppm	
Ni	200 ppm	
Hg	4 ppm	

All analytical results presented on a dry weight basis.

Cavaillon, France, Population 40,000

The most impressive facility visited during the entire tour was the SOBEA composting plant at Cavaillon. This facility was placed into service in 1978 at a capital cost of 10 million FF. The facility processes domestic refuse only with no sludge addition but adding water if necessary to increase the moisture content.

The process consists of introducing raw refuse to a rotating drum providing four days retention under aerobic conditions. Discharge through a double concentric screen forming part of the drum, is followed by ballistic separation of the heavies and shredding of the raw compost prior to windrowing.

Although the plant was designed to process 80 tonnes of refuse daily, at the time of the visit only 36 tonnes of refuse was available on a daily basis. This reduced throughput may contribute to the excellent performance observed and the apparent high quality of the finished compost.

The operating staff for the facility consisted of three men. The plant operates for 42 hours per week. No information on operating costs or local tipping fees was available.

The plant facility itself was clean, simple, and appeared to be efficiently operated.

Although 3 to 4 months of compost product was in storage during the time of the visit, the SOBEA Company claims to be marketing some 90,000 tonnes of compost produced annually at their 30 composting plants within France. Approximately 30% of this is sold to mushroom growers with the balance going to vineyard applications and market gardens. There does not appear to be any requirement for routine testing of compost with respect to heavy metals, or any regulatory concern over compost quality. This is probably because the material is produced from domestic refuse exclusively without the use of sludge or commercial/industrial wastes. The SOBEA compost is marketed in a price range of 18 - 35 FF per tonne, F.O.B. processing plant, with the average price being 27 FF per tonne, or approximately $8 Can per tonne.

Based on technical information provided by the Company, typical characteristics of the SOBEA compost are shown in Table 7.

The compost product yield at this facility is in the range of 40 to 50 per cent of raw waste tonnage processed.

Table 7

"COMPOST DE L'ILE DE FRANCE"

Quality of Compost Distributed by the SOBEA Company: Analytical Information Supplied by SOBEA

Moisture		25 - 30%
pH	7.0 - 7.5	
C/N ratio		less than 25:1
Organic Content		35 - 40 %
Carbon Content		25 - 30%
Nitrogen		0.7 - 1.05%
Phosphoric Acid		0.5 - 0.7%
K	0.3 - 0.5%	
Ca	4.0 - 4.5%	
Mg	0.5 - 0.7%	
S	0.5%	
Fe	0.3 - 0.4%	
Manganese		300 - 450 ppm
Copper	30 - 40 ppm	
Boron	20 - 30 ppm	

St. Mitre, France, Population 100,000

The composting facility serving the communities of St. Mitre, Martigues, and Port de Bouc is the Brikollare type similar to that in Schweinfurt, Germany. The facility was placed in service in 1978 at a capital cost of 20 million FF. The plant is owned and operated by the municipality. Landfilling is the alternative disposal method.

The system at St. Mitre consists of processing only domestic wastes by shredding, screening, addition of sewage sludge prior to briquetting and ultimate shredding of the matured compost briquettes with subsequent compost finishing through screening or air classification.

The facility processes approximately 80 tonnes of refuse daily at an estimated operating cost of 130 - 150 FF per tonne, or $39 - $45 Can per tonne, excluding amortization costs.

Apparently the municipalities chose composting over incineration as a waste management method because of lower capital costs and as a means of disposing of wastewater plant sludge. However, no compost was being marketed and only a relatively small quantity of compost finds its way to local agricultural land. This is rather surprising as the land appeared to be in considerable need of soil amendment.

While extensive compost finishing equipment was in evidence, it appeared that equipment was for test work only and not used on a routine basis. All in all, it was difficult to perceive the rationale for the composting facility serving these communities.

No information on compost quality was available.

Melun, France, Population 80,000

Communities in the Melun area have formed a Municipal Syndicate that owns and operates the composting and incineration facility serving the area. The composting plant is a Carel-Fouche system featuring digestion towers in rectangular sections. Constructed in 1969 at a capital cost of 8 million FF, it is one of the older composting plants in France.

The processing sequence consists of ferrous removal, shredding, composting in the tall rectangular digestion towers, screening and windrowing. Wastewater sludge is not mixed with the shredded refuse prior to digestion, but in some cases is added to the final compost product or sold separately for independent application to agricultural lands. Water rather than wastewater sludge is used to increase moisture content in the digester feed if required. The composting system processes approximately 50 - 60 tonnes per day of refuse with approximately one-half of the material ending up as finished product.

Operating costs for the composting system were given as 100 FF per tonne or $30 Can per tonne. Corresponding incineration costs were quoted as being only 80 FF per tonne. A total of six staff are involved in the operation of the composting system.

Compost is marketed to local farmers for application to agricultural lands, with the material apparently being bought for its fertilizer value rather than its soil conditioning properties. The compost is sold for 13 FF per tonne, F.O.B. plant. One interesting feature at this plant is that the municipality rents trailers specifically designed for the spreading of compost or sludge to farmers at a rate of 2 French francs per tonne of material purchased. Compost application rates were indicated to be 30 - 50 tonnes per hectare. Again there did not appear to be any general concern over the quality of the compost being applied to agricultural lands.

No technical information was available on the quality of compost being produced at this facility.

Orlean, France, Population 150,000

This composting plant, a Carel-Fouche type, was constructed again by a community syndicate and placed in service in 1965. However, operation of the facility was tendered to a private company, Compagnie Generale Des Eaux, on a thirty year contract basis, renewable annually.

The processing system is identical to that at Melun with this plant processing 150 tonnes of refuse daily on a 2 shift per day basis. The operating staff consists of seven men per shift.

The direct operating costs for the composting facility were indicated to be 60 - 70 FF per tonne or $15 - $18 Can per tonne, excluding amortization. Operating costs for landfilling of wastes were reported as 15 - 20 FF per tonne.

There was very little evidence of windrowing of the raw compost. Apparently most of the compost is marketed to the mushroom industry and these users prefer raw compost with the heat available on subsequent digestion being essential to their mushroom growing operations. The mushroom growers have been purchasing compost for some 10 to 12 years. Apparently, earlier studies revealed no problems to exist in this particular application. Consequently, there is very little concern with respect to the quality of the compost and its end effects on the mushroom product. This is contrary to the view taken by the mushroom industry in Ontario. Compost is sold to the mushroom industry for 25 - 35 FF per tonne, or $6 - $8 Can per tonne. However, finished compost marketed to the agricultural community sells in the range of 10 - 20 FF per tonne.

An attempt was made to determine the rationale behind the municipal decision to use composting as a method of waste management. Orlean is situated in an agricultural area and difficulty in obtaining landfill was indicated as one of the prime reasons for this facility. Commercial and industrial wastes are not handled at the municipal facility but instead are landfilled. Again it would appear that a composting approach was chosen on a basis other than simple economics.

No analytical information on the compost quality at Orlean was available.

DISCUSSION

Technology Assessment

The numerous approaches to the composting of municipal solid waste observed during this trip indicated that a raw compost can be obtained fairly readily without being dependent upon a particular approach or degree of pre-processing. However, with one exception all of the raw compost produced required extensive windrowing prior to utilization or marketing. There did not seem to be any readily apparent difference between European domestic refuse and North American residential refuse that would inhibit using composting as a waste management method. While North American refuse might contain more glass, cans, and paper, the presence of increased quantities of any of these materials should not inhibit the composting process.

Any application of composting as a waste management system was limited to domestic refuse exclusively, with commercial and industrial solid waste handled separately. The use of sludge to increase the moisture content of the compost feed stock would appear to be advantageous but may have the effect of limiting the potential markets and usage for the finished compost.

The quality of the compost produced at the various facilities visited appeared to depend more on whether the system was operated within its design limits rather than on the type of pre-processing or composting system used. Indeed based on a comparison of the systems at Cavaillon, France and Siggerwiesen, Austria, the quality of compost produced was certainly not a function of the extent of pre-processing employed prior to the actual digestion phase itself.

It seems advisable for municipalities considering composting systems to seek as simple a system as possible, inherently minimizing capital costs, labour requirements, and general operating and maintenance expenditures.

In addition to the general requirement of windrowing of the unmatured compost produced, additional composting finishing steps such as screening will probably be required to ensure user acceptability.

Economics and Marketing

Perhaps the most fundamental concern that should be associated with the composting alternative is the recognition of a need for significantly higher tipping fees for such facilities than those for conventional landfill. Although higher tipping fees are encountered, composting features non-monetary environmental, and resource conservation, advantages that cannot be quantified in terms of conventional economic parameters.

In evaluating composting as a waste management alternative, projected over-all costs should not include anticipated revenue from the compost product. Invariably compost marketing takes considerably longer to develop than initially planned and in such cases the facility should be economically self-sustaining in the absence of compost revenue.

It must be recognized that approximately one-half of the refuse processed is reject material and requires disposal. Significant landfill capacity will still be required with a composting system and the cost associated with reject disposal must be acknowleged.

Based on the observations made during this visit, the utilization of compost in Europe as a whole is not well established when compared to the secondary materials markets for paper, glass, and some ferrous materials. Although individual companies marketed compost produced at their facilities, there was no evidence of compost utilization activities recognized on a nation-wide basis.

Consequently, the present status of market development does not allow generalized predictions of markets and associated revenues.

The presence of heavy metals in compost was generally not of concern in France while in Germany it was strongly felt that the heavy metals present in wastewater sludges used for moisture adjustment would eventually severely limit the practice of composting of domestic refuse.

CONCLUSIONS

1) The technology of composting of municipal refuse is well-established. The quality of compost produced does not appear to be a function of the extent of pre-processing employed prior to the actual digestion phase itself.

2) Finished compost production is equal to approximately one-half of the raw refuse processed, on an as-is weight basis.

3) Some type of additional compost finishing, beyond the simple maturation stage, is generally required prior to marketing.

4) Markets for compost are area-specific and depend on various end uses. There is no single overall universal market in existence for finished compost.

5) At this time, any application of composting as a waste management system should be limited to domestic refuse exclusively.

6) Composting costs, including revenues, are invariably greater than those for simple landfilling, although composting costs are probably less than those for disposal via incineration, without heat recovery.

7) Any decision to use composting as a waste management technique must recognize factors other than simple economics, i.e. non-quantifiable environmental advantages, reduced consumption of land for landfilling, and resource utilization.

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